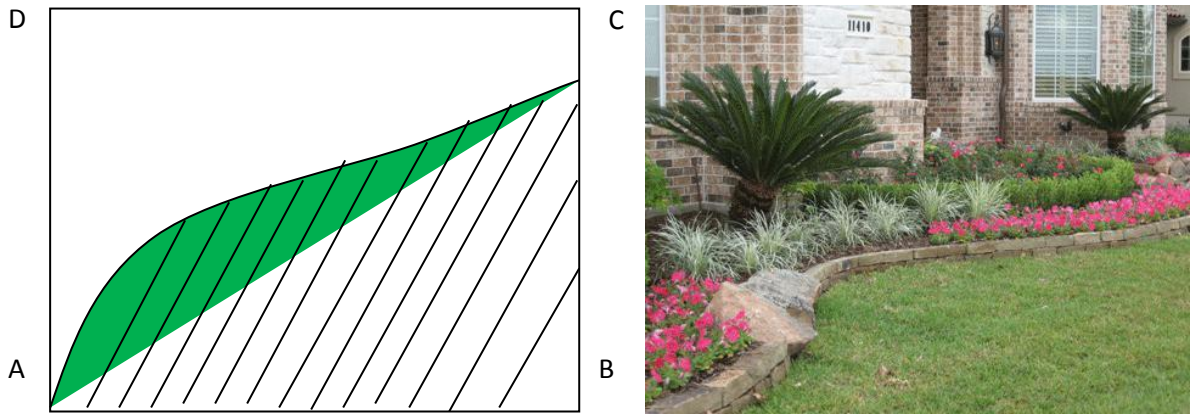
Numerical Methods (EM 314) – Lab Session

(Interpolation)

Problem:

An architect has requested your service to develop a software to plot the shapes he sketches. He also needs the estimates of the areas of the shapes, so that the amounts of material and labour needed and hence the costs may be estimated for the clients' information.

As a first step, you are developing a MATLAB function that sketches and calculates the area of a front yard landscaping of the following shape.



(a) (b)

Figure 1

(a) Using the script provided as a guide, read and understand the application of the MATLAB functions, ginput, spline and ppval. Familiarize yourself with the inputs and outputs of these functions beyond what is given in the example script.

(b) Consider a rectangular shaped garden where width (AB) is 20m and depth (AD) is 15m. Use a MATLAB script to plot a curve of shape similar to the one given in Fig. 1(a), when the shape is defined by
   (i) 3 points,
   (ii) 4 points, and
   (iii) arbitrary number of points.

(c) Write the polynomial functions that have interpolated the given points in cases (b)(i) and (b)(ii).

(d) For the cases (b)(i), and (b)(ii),
   (i) display the area of the hatched region on upper left hand corner of the plot,
   (ii) display the area of the shaded region on upper right hand corner of the plot.

(e) Discuss the accuracy of the method/s you used in part (d) to calculate the area.

(f) Repeat (b)(ii), (iii), and (d)(i) for the figure 1(b), where you have to trace the brick-lined edge and calculate the lawn area. (Scale: length of a pixel = 40 mm in the real garden).

(g) If the plan view of the Figure 1(b) is approximated by rotating the figure around horizontal axis so that the two edges (0, 448) and (332, 448) move to (0, 600) and (332, 600),
   (i) revise the splines you found in (f) to show the brick-line in the rotated figure, and
   (ii) calculate the revised area.

Note: The rotated image will look like Figure 2.

Figure 2

```
Clear
clc

figure
axis([0 50 0 20]);    % x_lims, y_lims
set( gca , 'XTick' , [0 : 5 : 50] );
set( gca , 'YTick' , [0 : 5 : 20] );
hold

[x2,y2]=ginput(3);
PP = spline(x2,y2);
xx=[x2(1):(x2(end)-x2(1))/100:x2(end)];
V = ppval(PP,xx);
plot(x2,y2,'.r')
plot(xx,V)


[x2,y2]=ginput(5);
PP = spline(x2,y2);
xx=[x2(1):(x2(end)-x2(1))/100:x2(end)];
V = ppval(PP,xx);
plot(x2,y2,'.r')
plot(xx,V)

% reading and displaying the image
[Image1]=imread('interp_fig1.png','png');
imshow(Image1)

% Rotating the figure
tform = maketform('projective',[ 0 0;  332  0; 332 448; 0 448],[0 0; 332 0;
332 600; 0 600]);
Image2= imtransform(Image1,tform);
Imshow(Image2);
```